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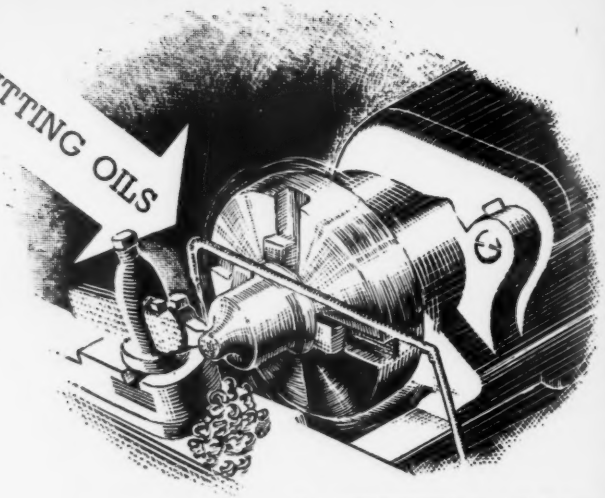

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OPERATION OF TANKER SHIPS*

By J. H. Jackson†

World Tanker Tonnage

Tankers are a vital element in the work of a large oil company and also form a very important branch of merchant shipping to-day. At January 1, 1950, the world's tanker seagoing fleet, excluding coasters, totalled nearly 2,000 vessels of approximately 25 million deadweight tons, compared with about 17 million d.w. tons at the out-break of the late war. This 25 million tons contributes over 20 per cent to the total of world merchant shipping tonnage. Average speed of this vast tanker fleet is estimated at 13 knots, about 50 per cent being 14 knots or over. Also, about 330 tankers of approximately 5¾ million d.w. tons are under construction or on order; more than half of these new ships will be over 16,000 d.w. tons, of which about 40 per cent will be in the 20,000 to 30,000 ton class.

Compared to pre-war the world's tanker capacity is up by about 70 per cent. U.S. flag tonnage has increased enormously due to the huge building programme carried out during the war when America built over 700 ocean-going tank ships (chiefly turbo electrically propelled, a form of motive power which has not been perpetuated by America since). There has also been a very marked addition in vessels flying

* Read before London Branch, Institute of Petroleum, December 29, 1949.

† British Tanker Co. Ltd.

the Panama flag, particularly in association with U.S.A. ownership, because of high running costs under U.S. flag and to some extent for reasons of taxation.

Age of Tankers

At present about 250 vessels representing, however, less than 10 per cent of the world's capacity, are over 25 years of age. The continuation in service of a tanker beyond what might be thought to be her useful life depends upon a number of things, and not the least the rate of hire she can get for service. Over 70 per cent of world capacity is at present under about 10 years old and over 40 per cent under 6 years old. The impact of war and the greatly expanded demand for oil since, may provide a building problem for the future, particularly in the U.S.A.

Oil Company and Independent Tonnage

Statistics show that about 55 per cent of the world's tanker tonnage is not owned by oil companies. Non-oil companies own approximately 41 per cent and the balance is owned by Governments and used as fleet oilers, etc. The owning of tankers is a commercial proposition showing varying measures of profit over the years. There may be periods when rates of hire are so low as to make hiring out unprofitable, but usually owners derive a small or high degree of profit according to the supply and demand. If, therefore, tanker transportation can show a profit, why do the oil companies not strive to own all the tonnage they need? There are a number of reasons why they do not, two of which are, firstly, a large tanker fleet requires a very large capital expenditure. Chartering tonnage therefore reduces capital needs in one part of an oil company's business. Secondly, it would be unwise for an oil company not to have a tonnage cushion to bear the impact of fluctuating needs, thereby keeping its own tonnage in service. This latter is highly desirable for several reasons; for example, ships do not improve when laid up; further, seagoing staff are liable to be drained away during a lay-up and difficult to bring together quickly when wanted.

The oil companies, therefore, use a great deal of tonnage in addition to their own. The rapid expansion of oil demand and the huge costs of post-war rehabilitation and extension of their producing, refining, and other facilities may have produced to-day a higher proportion of hired to owned tonnage than might have been the case in a period of more gradual growth.

Chartered Tonnage—Long and Short Service

The very considerable quantity of outside tonnage is hired, broadly, either for long or for short service periods. Long service tonnage is commonly taken in the form of time charter for, say, three or five years or more, sometimes in the form of so many years of consecutive voyages. Short service tonnage is chartered for a single voyage or one or two voyages and some tonnage is taken on for, say, nine to twelve months, perhaps two years; rather in between the short and long types. Occasionally tonnage is taken on bare boat charter under which the hirer, that is the charterer, pays so much per deadweight ton per month for the ship and he mans, stores, and repairs her, etc.; in fact he fulfils nearly all the functions of an owner and operates the ship like one of his own. These bare boat charters are not common, and leave a great deal of responsibility of an owning character with the charterer.

Charter Hire

Ships on time charter are paid for as a rule monthly in advance at so much per summer deadweight ton and the contract, the charter, stipulates when

such obligation can be suspended, e.g., during repairs. The charterer supplies and pays for bunkers and port charges.

A ship on voyage charter is paid for differently. Here the owner receives so much per ton of the cargo his ship carries from one place to another and he provides and pays for his ship's bunkers and the port charges she incurs. It is quite simple to calculate the voyage charter effect of a given rate of time charter on a particular vessel when a number of her characteristics, such as speed and consumption, are known, and also to evaluate the time charter equivalent of a voyage rate on a particular ship.

Charter Tonnage—Cushion

In a large C.I.F. oil business the cushion for variation in requirements is the short period tonnage margin which, provided tonnage exists (and it usually does) to offer service, is quickly engaged and quickly discarded after performing its contracted short service.

Freight Rates and Chartering

The basic determining factor of freight rates is, demand and supply of tanker tonnage. There should be one world market but with currency restrictions to-day there are really for the time being two markets, the sterling market and the dollar market. The rates in these two markets are not always the same, but the dollar market is not freely available to sterling charterers. The actual demand/supply picture is available to neither the oil company wanting tonnage nor to the owner willing to provide it. Therefore, the fears and prejudices and the experience which go into the making of a bargain interplay upon the rate finally agreed. Usually the oil company has more of the vital information than the outside owner but the uncertainties are such as to prevent anyone getting into a supreme position for any length of time and chartering becomes a matter of hard bargaining.

The long period rate fluctuates much less violently than the short period rate. Both at the moment are respectively between three and four times their pre-war level but have been higher, and in particular the short period rate during 1948 reached over twelve times the rate immediately pre-war and over three times the present rate. That high post-war increase, however, was very much lower than the freights paid after the 1914-1918 war. In 1948 the rate for U.S. Gulf/U.K. Cont. per ton of oil carried reached 123s. 6d. (and in some cases a little more). In 1920 the rate reached 240s. to 290s.

Tonnage Estimates

The means by which an oil company estimates its shipping requirements and matches these with the owned and chartered tonnage at its disposal varies, but a possible method is to convert an owned and chartered fleet into so many units of a standard type. Then, with an estimate of the overall carrying capacity of that type and the number of days in a year they will be capable of trading (calculated from experience), and certain other factors deduced from statistics, the number of ton/days available from the fleet at disposal can be calculated. On the other side it can be calculated how many ton/days are required to lay down the oil required in the various parts of the world. The difference can be brought back to a deficiency or over-plus of tonnage.

Tonnage Deficiency—How Met

The deficiency, assuming there is one, and there should be one, is the margin for further new buildings or chartering, and the proportion of that deficiency to be left for short period marginal fixing must be broadly decided upon and dealt with accordingly, bearing in mind that estimates are estimates. Every effort must naturally be made to avoid a surplus of tonnage. Tonnage on hand

without employment is bound to be very expensive.

Tanker History

The modern tanker has grown from small beginnings and there is some controversy over the earliest of bulk carriers but the *Gluckauf*, built on the Tyne in 1886, is quite frequently accepted as the prototype of the present ocean-going bulk-oil carrier. She was about 300 ft long and carried about 3,000 tons. To-day, a tonnage beyond 30,000 deadweight has been reached and a length between 600 and 700 ft. Pre-war the modern type of vessel was regarded as the 12,000-ton diesel tanker, although there were a few slightly larger ones. Some years previously the 10,000-ton steamer was the accepted modern tanker. The 12,000-ton type is still extensively in use by the two British major oil companies. It has a speed of 11 to 12 knots in service and is a very handy sized type for the varying needs of a world wide oil trade. When built with two pumprooms, it has a very considerable flexibility for the safe carriage of composite cargoes. The private owner, however, has for some years concentrated upon larger ships in which the proportionate capital outlay ton for ton is less and for which he considers he more easily obtains the rate of hire which attracts him. He generally builds a ship of 14,000 to 17,000 tons, quite frequently and very wisely with two pumprooms, and does not usually build a larger vessel unless tied up with a charter for a period of probably not less than five years, because large tankers have as yet a limited use.

General Layout of Tanker

The general layout of a tanker is of the three island type—fo'c'sle (which in older ships housed the crew, although in more modern ships they live aft), the centre castle (where officers—frequently engineer as well as deck—are berthed and where the navigation bridge is situated), and poop (where in some ships engineers and/or crew live). These islands are connected by catwalks or flying bridges, as passage on the steel decks is in bad weather sometimes impossible. The deck of a tanker is also occupied with valves, pipelines, and projections of various kinds.

The accommodation amidships is nowadays raised above the cargo deck, but some earlier tankers had the living space right on the steel or iron deck, and some tank valves were inconveniently situated in the saloon and in the officers' bedrooms. Although these early ships were primitive compared to the finely appointed ships of to-day the personnel were very happy in them. Some carried auxiliary sails; in some, engines were amidships and a few burned coal, not oil. Engines are now usually placed aft for safety and to avoid a long shaft tunnel through tanks, which would be a source of potential leakage trouble.

Tankers built to-day are generally of the wing tank type, that is they have two longitudinal bulkheads dividing the tanks athwartships into three compartments. Earlier tankers had one longitudinal bulkhead with trunks in the upper sections and summer tanks. The object of the bulkheads is to reduce the extent of the free surface of liquid in the cargo tanks, and so prevent surging and possible damage. It is not possible to fill tanks completely because of the high coefficient of expansion of the liquid carried. Sufficient space must be left to allow for varying temperatures and, when loading at 60° F, it is usual to leave about 2 per cent of the capacity of the tank empty.

Ship Management

General

Where a company has a small fleet of tankers the operation of these ships in some considerable detail can be carried out at quite a high level of management or ownership, but in the big oil com-

panies, with their huge fleets, the organization must be directed in such a way as to provide a devolution of responsibility which carries with it the initiative and keenness of ownership. Every tanker day not properly used means a loss of some hundreds of pounds and changes in programme require careful and experienced consideration in order that the right decisions may be taken and such losses avoided. The initiative and interest of ownership down the line can be provided partly by appropriate organization, but it must in addition be inspired and kept alive by close touch with the company's management. The person finally responsible for the movements of a ship—the ship operator or ship manager, whatever he may be called—should be made to feel the vital importance of his job and that the ship must be run in the way he would run her if she were his own.

Programming of Voyages

In deciding upon a particular voyage draft at both loading and discharging ports must be watched so that too deeply drafted a ship is not used. Cargo quantities must be arranged to take full advantage of the whole deadweight space in the ship and if a chartered ship is used the terms of the contract with the owner must be studied. Ships on time charter involve a number of problems somewhat similar to those of ownership. In planning the voyage of an owned tanker, the operator (who must work in close touch with the official on the oil side) must watch that the ship is properly manned, that the contract of employment with the crew (Articles of Agreement) is not shortly due to expire; that the ship is adequately stored for the voyage; that her history of outstanding repairs, including periodical drydocking, is such as to permit of the voyage; and most important of all that she can in fact load the cargo required. Single grade cargoes are frequent and raise no stowage problems, but there are many cargoes of mixed grades which are sometimes coupled with multiple port discharges, and these reveal their own stowage difficulties, particularly if a ship is getting old and the tightness of her bulkheads and pipelines is uncertain. Varying refining and marketing needs require a flexibility in tonnage and demand changes in programming. A ship slipping from programme due to some delay or a change in need at the receiving end can affect the already agreed future voyage arrangements for a whole series of vessels.

"Black" or "Clean" Tankers

Generally speaking tankers engage in carrying crude from source of production to a refinery, or products from a refinery to distributing points. They are classified either as "black" (or "dirty") and "white" (or "clean"), the "black" oil vessels carrying crudes, fuels, diesel oil, and sometimes gas oil, and the "white" oil vessels, kerosines and spirits. Lubricating oil is another but rather specialized division. It is not practicable to interchange from "black" to "clean" oils without a considerable cleaning process, so that such interchange does not in fact take place, but it is a matter of policy how long a ship is kept in the "clean" oil business before she is transferred for a spell to the "black" oil trade.

A tanker as a rule carries cargo only one way, returning to a loading port ballasted with water. All tanks are not ballasted, only those necessary to give the vessel sufficient stability for the voyage in question and to secure the better speed and lower consumption that is possible in her lighter condition. Ballast can be adjusted during passage, as weather conditions or other circumstances require. A system of using different tanks for carrying ballast on different ballast voyages is often adopted towards avoiding unbalanced wear and tear in particular tanks. Tanks are as a rule

washed out and cleaned, sometimes to some extent before sailing, particularly if drydocking, but usually during ballast passage, in order to arrive at the loading port in "clean" condition. Tank washings are discharged at sea well away from any coast and there is an international understanding that oily water shall not be discharged nearer than 50 miles to any coast. At some loading terminals it is possible to discharge dirty ballast water into slop tanks ashore or separator containers, but the arrangements for reception of sludge ashore are not yet well developed.

Programming

Reference has been made to certain general interests which must be watched in programming ships, such as draft. The size of the vessel needed will be governed not only by draft considerations in the port and in the approaches thereto, but will be affected by the size of entrance locks and channels, and by the shore tank storage capacity at the installation. The suitability of a particular ship for composite cargoes will depend on her general condition, her pipeline system and pumproom arrangements. The pipeline system required varies from the simple arrangement to manipulate homogeneous cargoes to the complicated layout essential in the lubricating oil trader, which requires to segregate many small parcels of different grades. The suitability of a ship for a projected cargo will also be affected to some extent by the cargo or cargoes she has just previously carried, and as previously mentioned the various shipping aspects such as repairs position, stores and crew, etc. Furthermore certain cargoes require heating coils and these, where fitted (and they are usually fitted in "Black" oil ships), must be maintained in efficient condition.

The planning and programming of a tanker fleet is a complex matter requiring close understanding and cooperation between the ship operator and the oil people, the latter being responsible for computing forward estimates based upon constant stock advices, production, and offtake estimates of the many grades of oil now on the market. The task of collecting all necessary data and weaving it into a forward programme for even three months ahead requires considerable patience and ingenuity. The very fact that the ordinary consumer in normal times is seldom if ever unable to obtain on request his requirements is a tribute to the success of the system used by those concerned in the distribution and transport of petroleum and its products in their various stages from the source of supply to the retailer. At the same time such a programme is influenced by many unpredictable occurrences, and changes in loading orders and cargo requirements are frequently necessary and often embarrassing, and if the original programme as worked out represents a good arrangement any changes with the improvisations necessary are bound to produce difficulties.

Regulations

In a tanker fleet it is necessary to lay down a considerable body of regulations not only aimed at safety but also at efficiency. Port authorities generally also have special regulations in relation to the handling of petroleum products, particularly those with a flashpoint below 70°F. Generally speaking whilst handling these low flash oils no other operations are permitted to be carried out at the same time. For example no repairs, in fact usually no storing should be carried out. Fires are usually not allowed on board the ship and shore steam is frequently provided for ships auxiliaries during handling of dangerous oils.

The actual loading and discharging times depend on a number of factors, including size of shore lines, capacity of pumps, number of grades to be handled, distance between ship and shore tanks,

etc., but in most instances a tanker can discharge or load within the period of 12 to 48 hours.

Unusual Cargoes

It may be of some interest to mention unusual employment and special cargoes of tankers especially in times of emergency. Fresh water is frequently carried, to Gibraltar for example. Grain in bulk has been carried during the war successfully. Vegetable, fish oils, and molasses are regularly carried in tankers. In fact almost any liquid that can be made to flow can be handled. Special care has to be taken in preparing the tanks beforehand and afterwards, of course, for the next cargo to be loaded. During the last war quite a number of tankers were fitted with a skeleton deck over their main deck for the purpose of carrying bulky cargo such as aeroplanes and aeroplane parts, motor launches and other types of craft—in fact cargo which took up a considerable amount of space but was not in itself very heavy.

Another useful war purpose served by some tankers was to fit them out as merchant aircraft carriers (MAC ships) by building a flight deck over the main deck. In addition to carrying the usual cargo of fuel or diesel oils they served as aircraft carriers and escorted convoys across the North Atlantic.

Tankers are specially constructed for the purpose of carrying liquids in bulk, but most have a small dry cargo hold for the stowage of ship's gear but usable for packed oil and dry cargo. Such packed cargo is, however, wholly dependent upon the bulk cargo and the facilities at loading and discharging port as to whether such space can be used at a cost that will bear any relationship to similar shipments by regular cargo vessels. Delay is of course the real point at issue and 24 hours delay for the sake of 50 to 100 tons produces a freight rate usually out of all proportion to the value of the services rendered. Tankers too, of all ships, must be kept always afloat.

Statistics and Legislation

Tankers are merchant ships and successful management requires much of the knowledge and experience which goes with ordinary ship owning. A high degree of statistical information and costs is required in order to understand what can be got from a fleet both in its physical capacity to transport oil and in the cost of doing so, and this statistical information has to be tabulated at regular intervals and the results of analysis submitted to the management, so that general policy may be assisted in its direction along the most efficient lines.

Merchant shipping is regulated by a wide series of legislative enactments with which those responsible for a tanker fleet must be familiar and they must have an understanding of the now rather involved labour code applying to the employment of seafarers, besides having some acquaintance with ships' classification rules, bills of lading, charter parties, etc., and with a variety of organizations associated with shipowning.

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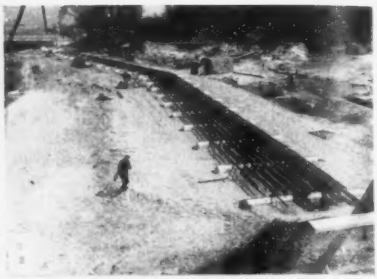
SWISS FUELS AND LUBRICANTS CONFERENCE

An all-day conference on fuels, lubricants, and chemical products from petroleum was held on April 22 in Zurich under the auspices of the Swiss Association for Testing Materials and the Swiss Institute for the Study of Motor Fuels. The following papers were presented: "New developments in the field of liquid fuels" by F. L. Garton, F. Inst. Pet. (Shell Petroleum Co.); "The testing of lubricants" by C. S. Windebank, F.Inst.Pet. (Esso Development Co. Ltd.); "Crude oil as a raw material of the chemical industry," by J. C. C. Boot (N. V. de Bataafsche Petroleum Mij.).

About 120 people attended and the discussions following the papers were lively.

FAWLEY REFINERY TAKES SHAPE



"Esso" Photographs

1. This complete concrete plant, 100 ft high, has an output of 140 cu. yd/hour. Below the hopper is a mixing room in which aggregate, sand, cement, and water are weighed to within a pound of requirements.
2. These pipelines will provide a direct link between the old and new refineries.
3. In the foreground is the copper sweetening unit, with a crude oil unit taking shape in the background.
4. The construction camp which provides all facilities for the labour force.
5. A general view looking towards the entrance to the new Esso refinery. The unique maintenance building is on the left.
6. A two-stage crude unit in course of erection showing how this type of plant can be fabricated in situ.

Although it is only about a year since work started on the new Esso refinery which Anglo-American Oil Co. are building at Fawley, near Southampton, considerable progress has been made. The accompanying photographs show how typical pieces of refinery plant are now being assembled.

Designed for an output of 5 million tons of petroleum products per year, as compared with the present installation's output of 900,000 tons, the new refinery when completed will be the largest in Europe.

Plant for the refinery will be of British and American manufacture but process units will be of U.S. design. The main units of the plant comprise two pipe stills, a catalytic cracking unit with ancilliary treating and sweetening plants for gasoline, and an Edeleanu plant for SO_2 treatment of kerosine and gas oil. The catalytic cracker will take gas oil as feed stock and will produce about a million gallons of motor spirit per day.

It is not proposed to produce petroleum chemicals, but unsaturated gases from the cracking unit will be available for this purpose should it be decided to manufacture such chemicals.

The new refinery covers some 450 acres and eventually the personnel will number about 2,500 as compared with 900 in the existing plant.

Total crude oil storage will be sufficient to hold about 15 days supply for a throughput of 110,000 barrels per day. Storage for refined products will be equal to about 25 days' production.

Crude oil will be brought in from the Middle East and docks will be designed to take 28,000 ton tankers with the possibility of larger vessels being berthed as they become available. There is at present one ocean jetty serving the existing refinery capable of berthing tankers of up to 18,000 d.w. tons.

The initial phase of the construction of this refinery is substantially complete and recently the foundations of the largest fluid catalytic cracking plant in Britain were laid. This operation involved the pouring of over 30,000 cu. ft. of concrete over an area of 5000 sq. ft. in one day.

It has been necessary to build a construction camp to house, feed, and entertain a force of workers which it is anticipated will amount to over 4,000 as work proceeds.

An important feature in planning the development work is the provision of a single maintenance building. This 800 × 180 ft building will contain all workshops, warehouses, foremen's offices, etc., and will be equipped with modern machine tools and travelling cranes. Thus, unsightly huts and temporary buildings will be avoided and the maximum number of men will be able to work under conditions calculated to give utmost efficiency.

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WORLD POWER CONFERENCE

Among those who have accepted membership of the Grand Council of the Fourth World Power Conference, which is being held in London from July 10 to 15, are R. A. Carder, chairman and managing director of Anglo-American Oil Co., Sir William Fraser, chairman, Anglo-Iranian Oil Co., Sir Frederick Godber, chairman and managing director, Shell Petroleum Co., C. M. Merrick, chairman, United Kingdom Petroleum Industry Advisory Committee and C. A. P. Southwell, President of the Institute of Petroleum, and managing director Kuwait Oil Co.

★ ★ ★

The Dy-A-Flex air clutch for use with Ideal type 100 Draw Works is shown in a four-page bulletin (No. 1-364) obtainable from The National Supply Co., Box 889A, Toledo, Ohio.

PERSONAL NOTES

Sir Alexander McColl, F.Inst.Pet., has retired as director of the Vacuum Oil Company, after having been connected with the firm for 45 years. The vacancy on the board has been filled by **J. Blake Middleton,** who will take charge of Vacuum's manufacturing department and be responsible for the design, construction and initial operation of the company's projected new refinery at Coryton.

Chief Engineer James Lyon Fraser, who served for 30 years with the Shell tanker fleet, retired in April. He had been permanent Chief Engineer since 1936. During the last war, while serving in the eastern Mediterranean, his ship *Volsella* was repeatedly dive-bombed while bringing in oil supplies to the Allied forces in Tobruk.

William J. Haley has been elected president of Esso Export Corporation in succession to **Frank M. Balling,** who will remain a director pending his retirement in the near future. Mr Haley's post of co-ordinator of the refining operation of Standard Oil Co. (New Jersey) is being filled by **Harold W. Fisher.**

Robert Annan, a past-president of the Institution of Mining and Metallurgy, has been awarded the Institution's Gold Medal in recognition of his distinguished services to the mining industry and mining profession.

We tender our congratulations to **T. C. Owtram,** M.Inst.Pet., on the award of the M.B.E. (Military Division), which has only recently been announced. Mr Owtram, who is head of the Economics Section of the Trade Relations Department of Shell Petroleum Co. Ltd., served in the War Office from 1939 to 1945, first as a captain and later as a major. He is a member of the Papers Sub-Committee of the Institute.

Included in the Honours List on the occasion of His Majesty's birthday were: **G. Legh-Jones** (*Knight*), a managing director of Shell Transport and Trading Co. Ltd.; **Sir Ben Lockspeiser** (*K.C.B.*), secretary, Department of Scientific and Industrial Research; and **Commdr. J. G. Detchon** (*O.B.E.*), chief engineer, s.s. *British Lord*, British Tanker Co.

R. B. Southall, F.Inst.Pet., general manager of National Oil Refineries Ltd. and a Member of Council of the Institute, has been elected a vice-president of the Industrial Association of Wales and Monmouthshire.

Arnold Hofland, O.B.E., general manager of Deutsche Shell A.G., has been appointed to take charge of European Area Management of the Shell group in succession to F. A. C. Guépin, recently appointed a director.

A. de Graan, O.B.E., formerly general manager of Shell Italiana S.A., has been appointed to succeed Mr Hofland as general manager of Deutsche Shell A.G.

F. L. Garton, F.Inst.Pet., member of Council, is going to Singapore on a temporary assignment this summer. He will be leaving England at the end of August and will spend some time with the Technical Department of the Shell Company of Egypt in Cairo on the way. He is due to arrive in Singapore about the middle of October and will be in charge of the Technical Department of the Shell Company of Singapore for several months. He expects to return to London about the end of June or early July 1951.

A SURVEY OF ACCIDENT PREVENTION IN INDUSTRY*

By W. C. Sydenham †

The need for organized safety is greater now than ever before. The cost of accidents, measured in loss of life and human suffering can be said to constitute a serious menace to modern progress. The economic loss too, is considerable, reckoned in terms of productive man hours.

It may well be said, if such is the state or condition of things, "What is being done or what will be done to rectify them?"

In most countries organizations have been created to deal with the problems that arise from the result of accidents and to devise means and measures to prevent such accidents. The Factories Act, the Workman's Compensation Act, and other statutory instruments and regulations, have been built up as a civil code of operation for factories and work places in Britain. Acts similar to these, with comparable objects in view, have been made law in most countries, providing a measure of protection against accidental injury during industrial occupation. Road safety too, has not been neglected. By legislation, through the medium of insuring corporations, and by voluntary organizations, much has been done to prevent casualties on the road. In Britain all are familiar with the Highway Code and the campaign sponsored by local government bodies with the object of reducing road casualties.

Whilst measures have been taken to reduce accidents by legislation, these measures have been determined in the greater part by the industrial development of the countries concerned.

In the countries which are largely agricultural and not so highly industrialized as the Western countries, such safeguards in the industrial field are less advanced. But the amount of industrialization in any country must not be taken as a measure or indication of the requirements of safety measures. The need for safety is universal. The terms of reference for safety are much wider than Safety First. They are safety first, last, and all the time. Safety never ends. Legislation only outlines the requirements of the law, the action which can and *must* be taken, not the limit of care and accident prevention work, which can and *should* be undertaken.

A government department does not undertake to formulate a law until it sees a need for it. In the early days of accident prevention legislation, the constant recurrence of a known type of injury and its cause was the formula for such legislation. Nowadays, most industrial undertakings take preventive measures by setting up their own safety organizations to meet their own particular requirements, and this, in turn, has led to the development of the Safety Engineer's Department.

The Safety Department in most organizations has a staff function. Its purpose is to correlate and co-ordinate all matters relating to accident prevention, stimulate interest, investigate accident causes, accumulate statistics and prepare statistical reports, make recommendations, inspect for hazards, keep up to date on new developments, provide adequate safety equipment,

* Read before S. Wales Branch of the Institute on November 4, 1949.

† Senior Safety Engineer, Anglo-Iranian Oil Co.

make available information concerning safety problems and hazards, in short, to assist in every way to prevent accidents.

The establishment of the department does not mean that the safety engineer is solely responsible for the safety of personnel and plant. Safety is everybody's business and there are direct responsibilities which must be assumed by everyone in an organization if the programme is to function effectively.

An analysis of these responsibilities, as recognized by large industrial concerns operating successful safety engineer's departments, indicates that they come under three main headings.

1. The General Management.
2. The Works Management
3. The Working Force.

The General Management

The responsibilities of the general management, that is to say the general manager and chief safety engineer are.

(*a*) *To establish personal policies calculated to achieve those relations which engender peace of mind on the job;*

(*b*) *To plan and support the safety programme and to ensure support at all levels;*

(*c*) *To define and establish safe working places, equipment and methods as required by the law, supplemented by such domestic regulations as are necessary;*

(*d*) *To plan and maintain a programme of safety training.*

The Works Management

This consisting of area, field, and division managers or superintendents—according to the set up—and the safety engineer, are responsible for:—

(*a*) *Putting the safety programme into action;*

(*b*) *Providing safe working places and equipment;*

(*c*) *Ensuring safe operating methods;*

(*d*) *Arranging safety training of foremen and facilities for the foremen to train all workmen under their supervision;*

(*e*) *Gaining and maintaining the active co-operation of supervisors, foremen and the workmen in working safely.*

The Working Force

This force, including supervisors and foremen should

(*a*) *Recognize themselves as the prime beneficiaries of the safety programme;*

(*b*) *Acquire safe work habits and a sense of responsibility for the safety of themselves and their fellow workers;*

(*c*) *Realize that personal safety can be achieved and maintained at work level only through the active participation and whole-hearted co-operation of everyone concerned;*

(*d*) *Subscribe in every possible way to the common objectives of personal safety.*

Safety depends on two things—the right attitude of the individual and the need for providing him with working conditions free, as far as humanly possible, from any form of hazard.

Regulations are of no use to anyone unless they are understood and observed, so it is first essential to make sure that the individual not only understands the regulations fully, but also understands why they are necessary.

The whole of the activities of a well organized safety department is concerned primarily in training the individual in these two matters, and all the various steps taken by way of safety committees, lectures, meetings, posters, slogans, etc,. only set out to achieve this

end. If they can develop safety consciousness in the mind of the individual, then they have achieved their objective.

It being impossible to rely on the individual to look after his own safety, it becomes necessary to prevent him injuring himself if he feels so inclined or is careless at any time, and, on this account we are compelled to take steps to make accidents unlikely, and ensure that the individual himself is protected from coming into contact with anything which might cause bodily injury.

Such then, is the broad outline of the function of the safety department, which illustrates the necessity for a carefully planned line of action.

The Safety Programme

Accident prevention programmes cannot be carried on by guesswork. They must be based on an accurate knowledge of all accidents which occur. Complete records must be maintained of all injuries, however slight, and of accidents to plant that may have resulted in injury.

The basis of all accident records is a full and complete accident report, resulting from a thorough investigation of the accident. Such an investigation will provide the answers to "who?", "what?", "why?", "where?", "when?", and "how?", as long as the investigation is aimed at prevention rather than the claim or liability aspect of the case.

The facts thus obtained provide the fundamental basic information necessary for the work of any accident prevention organization, from which a comprehensive knowledge of accident possibilities and a complete set of records and statistics can be built up.

From the knowledge of accident possibilities, preventive action in the way of personal protective equipment, improved machine design, essential domestic regulations and a host of other measures can be planned and put into effect.

Careful analysis and study of the records will reveal the causes of accidents, the frequency with which the different types occur and severity of accidents from the various causes, although the last is a very variable factor and can only be related in a general way to groups of occupations or types of work.

Apart from the all important humanitarian angle, accidents constitute a heavy burden upon industry, both in wastage and in costs.

The cost of an accident is not just a monetary payment in the form of compensation. Other contributory factors have to be taken into consideration in order to determine the actual cost. For example, if an operator sustains an accidental injury, the immediate loss is an experienced man for the period of his absence, whether it is a matter of an hour or several months. The less experienced man or even a new employee has to take his place. Such an employee has to be trained, which takes up the time of the supervisor. Moreover, a new employee is more prone to accident than the experienced worker, and is therefore an increased accident risk on the particular job. Other factors are, the general stoppage of work in the immediate vicinity of the accident, the cost of treatment of the injured person, damage that may have resulted to plant and equipment, the psychological effect on the other workers.

These are some of the factors which are contributory to loss and wastage by accidents in any industry—but they are not all. There is also the cost to the injured employee, which may be some major disfigurement with possible limitation of earning capacity and the disorganization and suffering of his household.

It may be considered that the "knowledge of possibilities" and the records furnish all that is necessary for building up an accident prevention programme and, therefore, the necessity for statistics may be questioned.

By statistics based on analysis of

correct information, the safety engineer determines the incidence and causes of accidents. Measures for preventing them at source can then be decided upon, and applied.

Records Analysis

The first concern is the incidence, or in other words, the number of accidents occuring over a set period. This figure will convey nothing unless it is in comparable ratio to the number of persons employed over a given period in terms of man-hours worked, or, in other words, a set period of accident exposure. To illustrate this, take two departments, one of which employs a hundred workmen and the other seventy-five. If in each department five men receive accidental injuries over the period of one month, the actual *number* is the same at five per month, but the incidence of the latter is greater because the number of employees is smaller. To bring these figures into ratio and establish a common factor, a universal rate has been determined by relating the numbers to fixed working period of 100,000 man-hours.

This is termed the *Frequency Rate* and in every-day language can be described as the method by which the frequency with which accidents occur over a fixed period of man-hours worked, can be determined. Thus:—

$$\frac{\text{Number of accidents} \times 100{,}000}{\text{Number of man-hours worked}} = \text{Frequency rate}$$

e.g. Number of accidents = 2

Number of man-hours worked = 50,000

$$\text{Frequency Rate} = \frac{2 \times 100{,}000}{50{,}000} = 4$$

In a similar way, the time lost through accidents is expressed by a *Severity Rate*. To arrive at this rate, the number of hours lost through accidents is substituted for the number of accidents in the formula. To give a case in point. If the number of hours lost through accidents equals 50 and the number of man hours worked equals 50,000, the severity rate will be:—

$$\text{Severity Rate} = \frac{50 \times 100{,}000}{50{,}000} = 100$$

Having determined the accident possibilities, compiled the records and established the frequency and severity rates, the Safety Department is now in a position to do a number of things.

(1) *To present an analysis which enables the various rates to be seen at a glance, and the incidence by causation, proneness, etc.;*

(2) *To assess the cost of accidents, individually and in bulk, with regard to monetary consideration in terms of compensation, medical fees, etc., time loss, efficiency loss, and the effect on plant economy generally;*

(3) *To plan prevention measures with the object of reducing the number of accidents;*

(4) *To determine the economy of accident prevention;*

(5) *To compare rates etc., with similar industries and undertakings.*

The use of an adequate system of statistics has, however, certain more precise advantages.

(1) *It enables the progress of the campaign to be judged;*

(2) *It gives valuable encouragement when the methods used to prevent accidents are successful;*

(3) *It directs attention to the need for replacement or revision of preventive methods and any new hazards which may have arisen unnoticed;*

(4) *It is useful as a means of propaganda because it brings to the notice of all concerned the success or otherwise of the accident prevention campaign.*

It is emphasized that the information required for the assembly of this data can only be obtained from a full and complete accident report after thorough investigation of the accident.

There exists a certain amount of controversy as to where such reports should begin and end—or in other words, what types of accidents should be reported.

In Britain it is at present incumbent to report to the factory inspector any accident which causes a loss of three days or more. Reports of these "reportable accidents" alone would not yield sufficient information to enable an effective accident prevention campaign to be planned, and so most undertakings have adopted the formula recommended by the Royal Society for the Prevention of Accidents whereby all accidents causing loss of time beyond the day of occurrence are domestically reported, and the industrial frequency and severity rates are calculated on this basis.

Simple as the formula may appear, there is some confusion and there are several schools of thought as to what should or should not be considered a reportable accident for the purpose of calculating the frequency and severity rates.

It is well known on both sides of the Atlantic that some undertakings pay more attention to the record than to the prevention of accidents, in that listing injuries as "Lost Time Accidents" has been avoided by returning an injured person to full-time employment on less important work than normal. Indeed, one example is recorded of a firm treating injured persons in a hospital established within the works and keeping them there until they were able, in the opinion of the firm's doctor, to return to ordinary duties or some other regularly established job. No record was made of lost time.

This is an evasion, as the standard method defines a "Lost time accident" as any injury which makes it impossible for the injured employee to perform his ordinary duties (or the normal duties of some other regularly established job not set up solely to avoid counting the case as a "lost time" injury) on the calendar day following the day on which his injury occurred.

It is not for a moment suggested that deliberate falsification of accident statistics is prevalent in any country,

It is suggested that a truer picture of the incidence of accidents would be obtained by calculating a frequency rate of all injuries, i.e. those causing loss of time plus those responding to first aid treatment and involving no loss of time.

When one considers the matter, the question of whether an accident turns out to be a "lost time" case or merely a "first aid" case is on many occasions largely a matter of luck. The safety engineer's job is to stop all injuries, and no matter how slight an injury may be, it is not possible for him to say how serious it may become before recovery is complete. Serious consideration by the safety engineer of a "first aid" case might eventually lead to the discovery of a potential source of danger, which would be quite capable of producing at any time, a fatal accident. It is therefore essential that he takes all possible care to prevent the minor injury and to consider it just as serious from the accident prevention point of view as others which incapacitate a man immediately.

Reports of minor injury accidents do have considerable value in that they often indicate a need for prevention devices and other precautionary measures. They give a much wider experience picture than when only injuries involving lost time are considered, and often provide danger signals before a serious injury results.

There are also considerable differences of opinion with regard to the value of the severity rate. It has even been publicly stated that it is of no use at all.

While it is true to say that the actual severity of an accident is beyond the control of the safety engineer, it is

qually true to say that severity records provide a ready means of assessing at least part of the cost of accidents, and this in turn provides one of the most useful tools in the accident prevention outfit. Perhaps this will be more easily understood by those not concerned with safety by the quotation of an illustration.

By virtue of the positions they hold, the management of all levels are always cost conscious, but the same cannot be said about their safety consciousness. If the safety engineer approaches the management on the subject of accident prevention he is accorded a hearing. But if he approaches the same people with a concrete method for reducing costs, he is invariably accorded an enthusiastic welcome. The way is then open to him to put over his most effective piece of propaganda—the reduction of costs by the prevention of accidents.

So long as these divergent views exist, the value of comparison is adversely affected, but it is worthy of note that considerable discussion, both written and in conference, has taken place recently with the object of clearing up such differences.

The Safety Engineer

Reference has been made several times to the safety engineer, the man whose job it is "to manage or bring about tactfully" the results required of a safety organization.

It is not difficult to assess the essential personal qualities required by the man who fills this peculiar post, which are primarily tact, diplomacy, and infinite patience. He should be easy to approach and difficult to discourage.

It is not, however, so easy to define the desired professional qualifications.

While, generally, a background of industrial training is desirable, it is not sufficient in itself. A man might be a professional mechanical, electrical, or chemical engineer, in the full sense of the word, capable and competent, but his normal training would not include the principles which are basic to safety engineering. To overcome this it is necessary for him to acquire some knowledge of psychology and of those processes and functions particularly applicable to the undertaking in which he is engaged. Processes of course, may be many and varied, but as the principles of safety are common to all operations, there should be no difficulty in their application. He is not expected to fulfil the impossible task of being an expert at all or any particular class of work, except safety, but he must be able, by co-operation, to utilize the knowledge of the expert on any particular process or job to enable him to apply the principles of safety. He must also be conversant with the requirements of the relevant legislation, and have some knowledge of the organization of statistics and propaganda, be fluent and possess, with the ability to apply, what is loosely termed "commonsense."

At the 1948 National Safety Conference sponsored by the American Society of Safety Engineers, the chairman of the Department of Industrial Engineering, Ohio State University, winding up his paper on "The Professional Status of Safety Engineers", said,

> "A knowledge of the basic, general fundamentals of engineering, coupled with a knowledge of the sciences which deal with man, both fundamentally and applied, will enable the professional safety engineer to operate in any industrial establishment positively and effectively."

This may sound somewhat academic but it does embody, in a few words, those attributes which are so essential to the make-up of the successful safety engineer.

Interesting and illuminating to the industrialist as they undoubtedly are, statistics have not been presented, as these are widely publicized through the medium of the Press and other interested sources, and can be referred to at any time.

The following instance, however, gives a picture of how statistics can be used to highlight a hitherto unsuspected fact. This is actually in connexion with fatigue in relation to accidents and was related by Sir Geoffrey King, the deputy secretary of the Ministry of National Insurance, at the recent National Industrial Safety Conference. He said:—

"I paid a visit not long ago to the Statistical Unit of the Nuffield Department of Social Medicine at Oxford. I had always imagined that fatigue played a large part in producing accidents. I was accordingly very interested when I was shown some figures which made it pretty plain that in one group of factories at any rate it was not the tired man or woman who met with the accident, but the man or woman fresh on the job. Accidents happened at the beginning and not at the end of a shift."

In the above an attempt has been made to co-ordinate contributions to the subject by such authorities as the Royal Society for the Prevention of Accidents, the National Safety Council of America, the Association of British Chemical Manufacturers, the Ministry of Labour and National Service, and by articles in numerous journals and other publications.

The author acknowledges the permission of the chairman and directors of the Anglo-Iranian Oil Co. Ltd. to publish this paper.

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BARSILLA TEST WELL

Traces of oil have been reported at the Barsilla (Assam) test well, according to a report from the Burmah Oil Co. (India Concessions) Ltd. Slight signs of oil have occurred in samples of sandstone rock brought up from a depth of 4000 ft.

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A new Precise Tank Gauge has been placed on the market by Evershed and Vignoles Ltd., Acton Lane Works, London, W.4., from whom details are available.

EDUCATION FOR LABORATORY TECHNICIANS

In view of the necessity for finding increased numbers of well-trained laboratory technicians for universities, technical colleges, industrial organizations, and research associations, the City and Guilds of London Institute has recently adopted regulations and syllabuses, which come into force in the academic session 1950-1, for the Laboratory Technicians Intermediate Certificate Examination. The scheme has been prepared by an advisory committee whose composition includes representatives of professional institutions, industry, the Ministries of Education and Supply, and associations concerned with technical education.

The proposed course of instruction lasts for three years and is on a part-time basis, attendance being required for 180 hours per year (day or evening). Teachers are to be free to arrange the order of work in a way that meets local needs. The Committee recommends that there should be an opportunity for students to do specialized work related to the laboratory in which they are employed. Normal age for entering the course will be sixteen.

The syllabus is divided into (1) Science and drawing; (2) General laboratory techniques and organization (including photography and projection), and laboratory workshop practice; (3) Specialized laboratory techniques.

This last section is divided into ten parts, among which are physics, chemistry, electrical engineering, and metallurgy, only one of which the candidate is expected to cover, the object being to familiarize the student with the use and care of the apparatus found in his particular laboratory.

Copies of the scheme are available from the Director, Department of Technology, City and Guilds of London Institute, 31 Brechin Place, London, S.W.7.

CONFERENCE ON MASS SPECTROMETRY

A conference on mass spectrometry organized by the Mass Spectrometry Panel of the Institute of Petroleum, was held on April 20-21, 1950, in the Trafford Park laboratories of the Metropolitan-Vickers Electrical Co. Ltd. Dr B. W. Bradford, chairman of the Institute's Hydrocarbon Research Groups, presided.

The primary purpose was to give those interested in mass spectrometry an opportunity to meet and discuss problems of current interest in friendly and informal surroundings. The growth and extent of activity in the subject is apparent from the fact that no less than 90 members attended the conference; the Panel was particularly happy to welcome eminent guests from Holland and France as well as many from Government establishments, university centres and industry throughout Great Britain.

The mass spectrometer itself is a device designed for the study of gaseous ions. It forms ions under controlled conditions and separates, weighs, and counts the different kinds produced. The ions are molecules or portions of molecules carrying a known charge; they can be propelled by an electric field, separated and weighed by deflecting their course in a magnetic field, and counted by measuring the total charge arriving at the end of their flight. The information can be used to find out what kinds of molecules constituted the gas fed into the instrument, or to learn more about the structures of the molecules and the forces which bind them together.

J. S. P. Paton, Dr B. W. Bradford, Dr F. H. Andrews and Dr A. J. B. Robertson inspecting a general purpose mass spectrometer (type M.S.2)

The technical discussions at the conference covered two main topics; first the fundamental processes of ionization, and second the use, in the practical field of quantitative chemical analysis, of the knowledge gained from understanding these processes. Dominating both these aspects of discussion was the instrument itself and its behaviour in regard to the problems being studied. As was said at the conference, "whilst the mass spectrometer is quite simple so long as only its general principles are considered, it is highly complex when the second order processes are brought into consideration, i.e. those which lead to errors in analyses or to different yields of ions under apparently similar circumstances." The technique for distinguishing between the phenomena due to the material being considered and those due to the instrument is often difficult and there is a real need for a consistent theory of the secondary processes involved in the production of the ions.

Other papers dealt with the preparation of standard materials used for calibration, with the preparation and use, in various researches of compounds containing the less common isotopes of carbon, nitrogen and oxygen and with measurements of the relative abundances of isotopes.

Sixteen papers were presented, as follows:

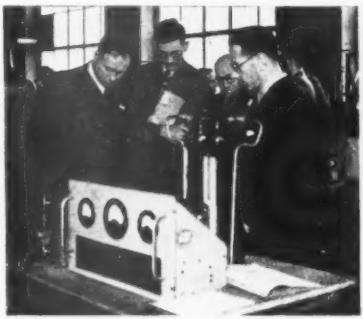
"The importance of appearance potentials in general chemical theory," Prof. M. G. Evans (Manchester University).
"The measurement of appearance potentials," K. Wood and J. D. Waldron (Metropolitan-Vickers).
"Determination of bond strengths from appearance potentials," C. A. McDowell and J. W. Warren (Liverpool University).
"Appearance potentials of halogen derivatives of methane," Dr J. D. Craggs and J. W. Warren (Liverpool University).
"The detection of free radicals," Dr A. J. B. Robertson (Royal Institution).
"Some aspects of mass spectrometry in France," Dr T. Reis (French Institute of Petroleum).
"Analysis of hydrocarbon mixtures," Dr F. Hageman (B.P.M. Laboratories, Amsterdam).
"Some factors affecting mass spectrometer analysis," D. L. Nicholson (I.C.I., Billingham).
"Ion sources using electron guns for mass spectrometry," Dr G. P. Barnard (National Physical Laboratory).
"General discussion on the design and operation of mass spectrometers," opened by J. Blears (Metropolitan-Vickers).
"The preparation and certification of standard hydrocarbon samples," Dr E. F. G. Herington (Chemical Research Laboratory).
"Enrichment of the heavy isotopes of carbon and oxygen by fractional distillation of carbon monoxide," Dr H. London (Atomic Energy Research Establishment).
"Preparation of chemical compounds containing carbon 13", Dr S. L. S. Thomas (Chemical Research Laboratory).
"Isotope abundance measurements," G. H. Palmer (Atomic Energy Research Establishment).
"The use of stable isotopes in biological chemistry," Dr R. Bentley (Medical Research Council).
"The exchange of oxygen 18 between oxygen gas and inorganic oxides," Dr E. R. S. Winter (Imperial College).

At a luncheon on the opening day, Mr E. W. Steele, director and general manager of works of the M-V.E. Co. Ltd., welcomed the members on behalf of the company and expressed pleasure at offering the facilities for the holding of such a conference on industrial premises.

An important and valuable feature of a conference of this kind lies in the informal discussions between those who have common interests but who normally have few opportunities for personal contact. The animated conversations which took place during intervals and during meals will linger pleasantly in the minds of all who were present.

Mr J. D. Waldron (left) explains methods for measurement of appearance potentials to Dr T. Reis, M. Margoloff, Dr James Bell, and C. Cassignol.

A further occasion for these more intimate discussions occurred on the evening of the first day when the members were the guests of the M-V.E. Co. at a dinner held at the Midland Hotel, Manchester. Mr B. G. Churcher, manager of the research department, was in the chair, and after the loyal toast, Dr C. Dannatt, director and



A demonstration of a molecular pump is watched by Prof. H. W. Melville, Dr C. J. Robb, A. R. Purchase, and Dr G. P. Barnard.

chief electrical engineer, proposed the toast "The Hydrocarbon Research Group," referring to the very friendly relations and the extensive mutual dependence of the electrical and the oil industries. On the one hand there was the supply of electrical machinery and power plant used in the field and in the refineries; on the other the supply of gas turbine fuels and of electrical insulating oils which, because of the efforts of the oil industry research workers, had improved so greatly and thus enabled switchgear and transformer designers to better their own products in turn. The development and supply of the mass spectrometer could be regarded as another instance of a contribution by the electrical industry likely to prove of assistance to the oil technologist in his problems of analysis and control.

Replying to the toast in a stimulating and witty speech, Professor F. Morton, a vice-president of the Institute of Petroleum, stressed the special urgency of demonstrating the accuracy and economy of using mass spectrometers as the principal analytical method for the new refineries now being commissioned. He pointed out that those responsible would, in a very short time, have to decide whether to use existing analytical methods or to go over to the new method. Whatever decision was reached, there would be no economic case for a change for at least five years.

During the afternoon of the second day an opportunity was afforded to the members of the conference to inspect some of the work of the M-V. Research Department in spectrometry, vacuum physics, microscopy, and in the high voltage field, and the tour of these laboratories was followed by a brief visit to a portion of the main manufacturing departments of the company.

In closing the proceedings, Dr Bradford expressed the view that the conference had clearly demonstrated the extent and the high technical standard of the work on mass spectrometry being carried out in Western Europe, and remarked that this must be a source of great satisfaction to all concerned.

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TANKER FOR NEW ZEALAND

The first post-war tanker built for the Shell Company of New Zealand, the *Tanea*, was recently launched at Sunderland by Mrs W. J. Jordan, wife of the New Zealand High Commissioner.

Designed for the carriage of white oils in bulk, and of packed oils in coastwise traffic, the m.s. *Tanea* has a deadweight tonnage of 3,100, an overall length of 332 ft, a 46 ft breadth and a draft of 17 ft 6 in. Of her six tanks two have been designed to take either packed cargo or bulk oils.

The tanker's engine is a 6 cylinder Hawthorn-Werksporr diesel, maximum b.h.p. being 1,500, giving 140 r.p.m. at the designed speed of 11 knots.

PETROLEUM IN PARLIAMENT

Haifa Refinery

In reply to a question on May 8, the Minister of Fuel and Power said: In normal conditions, the Haifa refineries can treat about 4 million tons of crude oil a year. American companies have a right to about a quarter of the products. The value of the British share of the products at present f.o.b. prices, was about £17,500,000 in 1947, and about £600,000 in 1949.

Imports

Asked on May 15, what is the percentage dollar content of imports of petrol from Bahrein, Kuwait, Qatar, Trucial Oman, British West Indies, Dutch West India Islands, Saudi Arabia, Iran, and Venezuela respectively, the Minister of Fuel and Power said it was impossible to calculate the dollar cost of petrol, as distinct from the dollar cost of other oil products with which it is produced. It was estimated that the average dollar content of oil produced by all British-controlled companies was about 30 per cent of its value; the average dollar cost of oil imported into the sterling area by U.S. companies is at present about 90 per cent.

Fawley Refinery

August, 1946, was the date on which his Department was first approached by the Anglo-American Oil Company regarding the expansion of Fawley refinery, said the Minister of Fuel and Power (May 15).

Pipelines, Middle East

The Minister of Fuel and Power was asked (May 15) the value of the contracts held by British manufacturers cancelled because of the inability of Middle East Pipelines Ltd. to secure wayleave rights from the Iraq Government and whether he would arrange for reconsideration of the decision to postpone construction of the pipeline until the autumn of this year and make the necessary representations in order to secure wayleave rights. The Minister said he understood M.E.P. had cancelled no contracts, but he had no information on what the main contractors had done with their sub-contractors. Whether or not plans would be proceeded with was a matter for M.E.P. In answer to a further question, which mentioned October 1953 as the date for resumption of work, the Minister said he understood construction had been postponed from autumn 1949 until autumn 1950.

Imports into Japan

Imports into Japan of crude oil from sources under British control had amounted to 66,000 tons since January 1950, when shipments of crude were recommenced, said the Minister of Fuel and Power on May 18. Imports of petroleum products in the last 12 months consisted of some 3000 tons of fuel oil. Payment was made in sterling.

Branded Petrol

The question of the sale of branded petrol was being kept under review said the Minister of Fuel and Power on May 25 in a written answer. He could not say when it would be possible to allow it to be sold. Under present circumstances it would involve uneconomic distribution.

Trade in Petroleum

Asked on May 25 why no clear and separate reference to the trade in petroleum products is made in his monthly Report on Overseas Trade, the President of the Board of Trade said it was designed mainly to give a broad picture. For details of trade in individual commodities reference should be made to the monthly Trade and Navigation Accounts on which the Report was based.

SIGNIFICANCE OF PROPERTIES OF PETROLEUM PRODUCTS

XIII. CARBON RESIDUE

By R. L. Martin and G. G. Stephens

Introduction

Petroleum products in the boiling range of gas oil and above can form carbonaceous deposits when subjected to conditions of heat where evaporation takes place.

It is necessary, therefore, that some indication be known of the extent of the deposition left by gas oil, or blended and residual fuel oils used in gas making, compression ignition engines and oil-fired burner systems, and by lubricating oils used in internal combustion engines.

Two laboratory tests have been standardized to this end, which by destructive distillation out of contact with air, give an idea of the relative carbon forming propensity of an oil. These are the Conradson and Ramsbottom carbon residue tests.

The Conradson test is used primarily for distillate and residual fuels while the Ramsbottom test is determined mainly on lubricating oils.

History

The standard tests now in use, viz., the Conradson and Ramsbottom methods, have undergone very little change since their adoption by the Institute of Petroleum in 1924 and 1935 respectively. They had, however, been used to a considerable extent before those dates. Details of the Conradson test first appeared in American technical literature towards the end of 1912 but, although the method was published by the American Society for Testing Materials in 1921, it was given only a tentative designation and was not adopted as standard until 1928. The Ramsbottom test was developed during 1920 for measuring the coking tendencies of aircraft lubricating oils before and after subjection to oxidation conditions. Details of the test were given by E. A. Evans in 1921 in his "Lubricating and Allied Oils" but although it was used in 1926 in aircraft lubricating oil specifications such as B.E.S.A. P.4, it was not in general use until the D.T.D. 109 specification appeared in November 1928.

Test Procedures

The Conradson carbon residue test consists of heating a sample of oil in a porcelain or silica crucible contained within two covered iron crucibles. The whole is surrounded by a sheet iron block or insulator and surmounted by a sheet iron hood. The apparatus is supported by a nichrome wire triangle on a tripod.

Heat is applied by a Meker type gas burner, the flame of which surrounds the base of the outer iron crucible to such an extent that the oil vapours are ignited within a specific period. The heating is then regulated so that the vapours burn at a uniform rate and the flame does not extend more than two inches above the hood. When the vapours have ceased to burn, the heating is continued for seven minutes with the lower part of the crucible at a cherry red colour, whereby all the volatile components of the oil are removed. The whole operation should take only 30 minutes. On cooling, the porcelain crucible is removed and weighed when cold, the result being expressed as percentage carbon residue on the original sample.

The Ramsbottom carbon residue is obtained by heating a sample of oil contained in a glass bulb, (a stainless steel bulb is specified in the A.S.T.M. Method) in a lead bath maintained at

a uniform temperature of 550°C (1022° F) for exactly 20 minutes. The bulb is then removed from the bath, weighed when cold, and the carbon residue calculated as a percentage on the sample.

Since most light distillate oils will give only very small quantities of carbonaceous deposits, the carbon residue by both methods is usually determined on the 10 per cent residue, obtained by an adaption of the distillation procedure for gas oil and similar distillates (Methods A.S.T.M. D.158 and I.P. 123) in order to increase the experimental accuracy of the test.

Applications and Significance

Distillate and residual fuels are utilized for a variety of purposes in which the deposition of carbonaceous materials from the fuel can have serious effects. The Conradson test provides a useful guide to the extent of the deposition and is included in most specifications for these materials.

The use of gas oil for the production of gas is an old established practice, indeed gas oil derives its name from this use. More recently residual fuels have also been used for this purpose. Several processes exist for the production of gas from oil, all based upon the cracking of the oil. The most important use of gas oil in this connexion, is the carburetting (or enriching) of water gas to give a gas of higher calorific value. Thermal decomposition of the oil takes place in the carburettor, with consequent carbonaceous deposition, and here the Conradson test is used to give an indication of the extent of this deposition.

Extensive use is made of these fuels in diesel engines for various purposes where the presence of excessive carbon deposits may have deleterious effects. In the high speed diesel engine the combustion period is relatively short. If fuels containing some residue are used, there is a tendency for the formation of trumpets of carbon at the tip of the spray nozzle, which normally has no special cooling arrangement. This can lead to faulty running and consequent loss of power. Therefore, gas oils with a minimum of high boiling components above 350°C, having a low Conradson carbon residue (*ca* 0.1 per cent) are preferred for this type of engine.

The high boiling components, which in the case of gas oil, result from entrainment during the course of distillation and fractionation during production of the oil, tend to form carbonaceous deposits.

Blends of distillates with residues or residual oils may be used as fuels in the medium or slow speed diesel engines. This type of engine is less critical of its fuel requirements than the high speed diesel engine and can tolerate, if well designed, fuels of relatively high carbon residue. Many engines, however, with insufficiently cooled spray nozzles may be subject to nozzle carbonization, followed by loss of efficiency and possible damage to engine parts.

The Conradson test does not differentiate between the physical characteristics of the carbon formed in the engine. Small quantities of hard carbon will be infinitely more injurious to the engine system than large amounts of soft fluffy deposits which can usually be eliminated by the exhaust system without harm. For this reason, the carbon residue test should always be considered in conjunction with other analytical data. Fuel oils with carbon residues up to 10 or 12 per cent have been used in marine diesel engines with satisfactory results.

The wide use of oil fuel in oil-fired burner systems has necessitated the use of varied types of burning equipment which are generally classified in accordance with the manner in which they prepare the oil for combustion.

The vaporizing type of burner is used mainly for domestic purposes, the oil being vaporized by bringing it into contact with a hot surface and the vapours subsequently mixed with con-

bustion air. This type of burner has the disadvantage that any residue formed by the decomposition of the oil on heating or incomplete vaporization is deposited on or near the vaporizing surface, where conditions are not favourable for the combustion of the residue, so that this type of burner is suitable only for the use of distillate fuels of low carbon residue.

Many types of burners are available which incorporate various devices (pressure, steam or air) to aid the atomization or breaking up of the oil into fine particles which are then mixed with the necessary air for combustion. Any carbon formed during the process is in a favourable state for complete combustion, so that residual fuels of high carbon residue may be used satisfactorily.

It may be said, therefore, that a knowledge of the carbon residue of a fuel can be a factor in assessing the suitability of the fuel for a particular purpose.

As far as lubricants are concerned, the Conradson carbon residue test was developed before a reliable oxidation test was available and it was thought that it would give an indication of engine performance. This was then generally associated with coke-forming properties in view of the fact that engines were of the splash lubrication type. It was soon apparent, however, that coke formation was more dependent upon the tendency of the oil to oxidize in the sump to produce asphaltic material than to the initial coke value of the oil, and this led to the development of the Ramsbottom test in conjunction with the Air Ministry oxidation test.

Even then it could not be proved that carbon residue tests were of practical significance in the performance of a lubricant in use. They were of importance, however, inasmuch as a low initial result or a low increase after oxidation would indicate a well-refined product which was essential for good performance.

With improvement in engine design, burning of the oil in the cylinder became less important and engine performance is now concerned with what takes place in the crankcase and not in the combustion space. The original conception of the carbon residue test has therefore lost its significance, but the test has derived a new importance as a measure of accumulation of deposits in the lubricating oil during use, because it is the only test which gives a measure of the total accumulation of asphaltic material, carbon soot, and free and dissolved inorganic material. In this connexion, the Conradson carbon residue is one of the tests specified in the standard procedure for the examination of used oils which have been submitted to engine tests by the method developed by the Coordinating Research Council. It must be stressed in the case of premium and heavy duty lubricating oils which may contain additives incorporating inorganic constituents that, unless the ash content of the unused oil is known, carbon residue results have no significance.

In fact, to obtain the full significance of carbon residue results they should always be considered along with other data. Thus carbon residue decreases with more efficient refining but increases with boiling range. It is, therefore, possible to produce a distillate oil with a low carbon residue which, because of poor refining and consequent poor stability, has an inferior performance to a blended high quality oil of higher carbon residue. On the other hand carbon residue results may be used with advantage to confirm information supplied by other analytical data, because they may help to indicate the length of a petroleum cut or whether blending of widely varying components has taken place.

Although it may be assumed from the above that there has always been some controversy regarding the practical significance of carbon residue tests, they

have nevertheless proved their value. So much so in fact, that they have been found of considerable use in the examination of many petroleum products even where practical "user" considerations would never arise, and this applies not only in the formulation of specifications but also in the many aspects of refinery control.

From a practical aspect, the Ramsbottom test is the easier of the two to manipulate, since the operating conditions of the test are rigidly controlled and a relatively unskilled operator can produce good repeatable results with only limited experience. This is not the case with the Conradson test. Here, everything hinges on correct heat control from the Meker burner and good results are obtained only after some considerable experience with the test.

In spite of its manipulative difficulties, it is considered that the results obtained by the Conradson test are as accurate as those obtained by the Ramsbottom test, provided sufficient attention to detail is taken during the determination. In fact, the Conradson result is probably more useful in the region approaching 0.05 per cent by weight.

Generally, the results obtained for the Conradson test are not in accordance with those obtained by the Ramsbottom test. The results obtained during an investigation into the two methods by Kelly* showed that a general relationship did exist over a wide range of carbon residues on varied types of oils. The A.S.T.M. also publish a table giving the average relation between the two tests which differs slightly from that of Kelly since two formulæ are quoted for use above and below a Conradson result of approx 2.1 per cent.

These relationships have been found to hold good for the majority of oils, but deviations have been known to occur and the increasing use of additives in lubricants has, doubtless, been a contributory cause. In this connexion it should be remembered that if inorganic constituents are present an allowance for ash content should be made before correlation of the two results is attempted.

The committees responsible for carbon residue tests have advocated since 1947 the replacement of the Conradson test by the Ramsbottom test but pending the results of further investigation into the correlation of the two methods, no definite decision has yet been taken.

Details of the tests are given in the Institute of Petroleum and American Society for Testing Materials Handbooks in Methods I.P. 13 and I.P. 14 and A.S.T.M. D.189 and D.524 respectively.

Petrol. Times*, 1938, **39, 429.

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JET FUEL COSTS

The type of fuel most suitable for the turbine-powered air liner and its probable cost are discussed by A. R. Ogston, F.Inst.Pet., in an article in the May 1950 issue of *Esso Air World*. The author predicts that during the next two or three years airlines will be placing orders for transport planes equipped with turbojet or turboprop engines, and it is therefore by no means premature to consider the question of fuel for these aircraft. There is little doubt, he says, that a kerosine-type fuel comes closest to satisfying the necessary requirements of maximum combustion efficiency, economy in fuel consumption, freedom from corrosive or deposit-forming characteristics and increased safety.

On the question of cost, Mr Ogston believes that a kerosine type of fuel should prove between fourpence and sixpence a gallon cheaper than the present airport cost of aviation gasoline used by ordinary commercial airlines.

Points the Judge Looks For is the title of the booklet issued by the Shell-B.P. Farm Service. Pictures of livestock are given, with the points of each animal numbered and described.

COUNCIL COMMENTARY

Readers, if such there be, who have missed this commentary recently are asked to accept this apology from the writer, whose private life has been considerably disorganized and changed of late due to retirement from industry, housefinding, etc.—entailing loss of office facilities.

Three Council meetings, taking place in February, March and April are here summarized. As the minuted items are 36 in number it will readily be understood that while commentary writers may come and go, Council activity does not stand still.

In the period since the last Commentary we have had a new Council election resulting in ten elected members from 507 ballot papers.

Though in line with many other societies, this is not a really heavy poll and should be larger if members wish to feel that they *control* council as a body as they should.

The members elected whose names have already been announced, include two who are new altogether to Council and one who is changed in status from nominated by Branches to elected by ballot.

Another event during the period has been a very successful Annual Dinner on February 28, the organizers of which are to be congratulated. It is hoped to improve the pre-dining arrangements for 1951.

An important matter which has been successfully concluded is the question of whether or not the Institute pays income tax as a business or is exempt as a charity, the latter happy position of *status quo anti* now having been restored as a result of good work by the honorary secretary, the By-Laws Committee, and the Council.

The Accounts presented to Annual General Meeting made more pleasant reading than of late years, and the happy financial solution, is in no small measure due to the generous support of a long list of Member-Companies who have joined within the year.

Arrangements for the Oil Shale and Cannel Coal Conference to be held in July in Glasgow were reported to be going well.

Mr Dewhurst reported the proceedings of the Parliamentary and Scientific Committee, on which he represents the Institute, and was thanked by Council for his work.

The period has seen the end of a very arduous and successful term of office by Mr A. E. Evans as President, and he was heartily thanked in Council by Mr Dewhurst in a resolution which was warmly acclaimed.

Mr C. A. P. Southwell was the unanimous choice of Council and he was installed as President at the A.G.M.

The following members, who have retired from Council, were thanked for their work over the years they had been members: C. T. Brunner, T. F. Laurie, E. Stokoe, and W. J. Wilson.

The report of the British National Committee of the World Petroleum Congress to be held in 1951 came before Council and comment by Dr E. B. Evans led to his co-option on the Committee and his suggestion that the writing of papers be "open to all" being adopted. National Committees to the number of 22 had now been formed.

Awards Committee recommendations that Mr J. Kewley be made an Honorary Fellow and that Col. Pineau, Sir H. Ricardo, Prof. L. Ubbelohde, and Prof. H. I. Waterman be transferred from Hon. Member to Hon. Fellow were approved.

Throughout the period the Election Committee has been busy, and some

10 Fellows, 6 Members, 27 Associate Fellows, 16 Associate Members, and 9 Students were accepted on their recommendation, together with 8 Member Companies. When the care and detailed study given to each application is borne in mind it will be appreciated that this very important committee does a great deal of work. As the members are busy men, their quiet but effective work deserves special thanks from us all.

Branches Committee reported that Birmingham Students Section had hammered out an acceptable set of rules and congratulations were extended to them and in particular to Prof. Morton.

The possibility and desirability of a junior medal award was raised by Prof. Morton, and reference was also made to desire of the branches for a revival of the Branch Lecture.

Publications Committee submitted two reports during the period dealing with various items not all routine. The delays in certain publications, largely as a result of war and post-war difficulties, have been studied with great thoroughness and there seems every prospect of much prompter and more topical publications in future. "Costs" and their allocation had been the subject of investigation by a special Committee who had presented their reports and recommendations. It was recommended that every effort should be made to get the *I.P. Review* into the hands of every non-corporate Branch Member.

It was decided to publish as booklets the Memorandum and Articles of Association and the By-Laws, and a List of Members, and a new Brochure.

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LABOUR TURNOVER IN U.K. PETROLEUM INDUSTRY

In November 1948 the British Institute of Management invited undertakings to submit their labour turnover statistics for analysis and publication. Returns are now published by the Institute covering 187 establishments with 310,374 employees, 215,499 being male and 94,875 female, during the first six months of 1949.

Results of the analysis are given in three tables. The first lists the industry groups and shows a percentage analysis of leavers in various categories. The second shows number of leavers in each group for each of 23 reasons for leaving. In the third table are shown (A) annual labour turnover rate by industries, (B) resignation rate as percentage of total leavers, and (C) rate of resignations for works reasons.

For the oil and petroleum industry, three establishments employing an average of 4613 males and 1017 females submitted returns. The number of leavers was 193 males (129 with over 12 months service) and 81 females (57 over 12 months service).

Commenting on Table III, the report states: "It will be noted that the oil and petroleum industry has a very low annual labour turnover rate for both males (8.2 per cent) and females (16.2 per cent). By far the greater proportion of this low rate is made up of resignations, and of these resignations less than 40 per cent for men and less than 30 per cent for women are resignations for works reasons. Moreover Table I shows that redundancy is the largest contributory factor to labour turnover in this industry. This suggests that this industry has less reason than some others to take stock of labour management relations and working conditions."

The full analysis sheets for each industry group and locality are available for inspection at the British Institute of Management, 8 Hill Street, London, W.1.

AROUND THE BRANCHES

FAWLEY, LONDON, NORTHERN, SCOTTISH, SOUTH WALES, STANLOW, TRINIDAD

South Wales Branch

The A.G.M. was held on February 7, 1950, at Britannic House, Llandarcy, under the chairmanship of E. Thornton, Branch Chairman.

The Committee for 1950, declared elected, were: R. B. Southall, E. J. Horley, J. A. Green, D. W. Thomas, T. F. Perry, J. L. Murray, P. F. Ellis, E. S. Squire and I. Cameron, the last three being the new nominations.

C. E. Jones and E. J. Jones were thanked for their past services and having agreed to act, were re-elected as Hon. Auditors.

The Chairman's Report for 1949 showed an increase of four corporate members, bringing the total to forty-seven. There were forty-four Branch members and twenty-two student members.

Nine meetings were held during the year and one of these was addressed by the President of the Institute.

The Annual Report of the Branch was presented by E. J. Horley and unanimously adopted.

During the meeting a presentation from the branch in the form of a silver cigarette box, was made by the Deputy Chairman, E. S. Squire, to E. Thornton, in appreciation of his services to the branch, on his retirement from active professional life.

The meeting concluded with votes of thanks to the catering staff of the National Oil Refineries Limited and to the officers of the Branch.

On March 2, 1950, at Britannic House, Llandarcy, E. Thornton delivered a talk entitled: "Twenty-eight years in one industry." Mr Thornton, who had recently retired from the staff of the National Oil Refineries Limited, spoke of his experiences in the oil industry, particularly at the Llandarcy refinery. He had been closely associated with many developments and had a wide experience. He dealt at some length with cracking plant operations, from the Dubbs and Cross to the cracking plants later developed.

His reminiscences brought forth an interesting discussion, in which many of Mr Thornton's colleagues paid tribute to his services and work in the industry.

Stanlow Branch

Stanlow Branch has made it a feature of its activities to provide its members with opportunities to see how other people work and to further this aim arranged for a visit to the Heysham refinery of "Shell" Refining and Marketing Co. on March 31.

The party arrived at Heysham at 3 p.m. and was immediately conducted to a conference room, one end of which was almost covered by a large map of the Heysham site. This map was used to explain the "lay out" of the installation and to show the general changes which had occurred since the plant ceased production of 100 octane aviation gasoline for war purposes.

During the war the plant was operated jointly by the Imperial Chemical Industries, "Shell" Refining & Marketing Co., and Trinidad Leaseholds. In February 1948 the "Shell" Refining & Marketing Co., purchased the oil plant from the Government and immediately began the job of converting existing plant for the production of motor gasoline from crude oils available in the sterling area.

This information was assimilated along with light refreshments, in order to make more time available for inspecting the installation.

Evidence of ingenuity and adapta-

bility was obvious throughout the whole of the installation. In one distillation unit a vacuum column was being used as the main crude distillation column and an atmospheric column had been modified for use as a fuel oil stripper. Fractionation equipment had been modified and installed as a stripper in a gas oil sidestream. Heaters were being used for entirely different purposes than those for which they were originally designed and the varied pumping equipment in use must be recorded as an outstanding example of the versatility of the engineers responsible for what they called "revamping" the plant.

The well equipped workshops presented a complete contrast to the refinery installation. Here one got the impression of having entered a paradise for engineers. Lathes, millers, drillers, grinders—big ones, small ones, tall ones, and short ones—all placed in ordered array in a huge shop, the appearance of which was enhanced by the unique colour scheme used throughout; a matt blue/green finish had been applied to all the machines and the effect was truly impressive, yet easy on the eye.

In the welding bay was a huge electrically operated contact welding machine which, amid a huge shower of sparks and minor explosions, welded together two 6 inch diameter steel pipes in a ridiculously short time.

Time, unfortunately, limited the extent of the tour. At 5 p.m. a substantial meal was served in the staff dining room and if any doubt as to the resourcefulness of the staff at Heysham remained, it was dispelled by the excellence of the meal provided.

In the evening the Stanlow Branch held its first meeting at Morecambe, at which Mr Kirby read his paper entitled "A Study in Adaptability" which had been presented before a meeting of the parent body in London on February 8.

Mr Kirby presented his paper in a most able and interesting manner. In it he describes how plants which had been used for processing hydrogenated gas oil were re-designed and modified for the conventional distillation of crude petroleum. How a vast amount of work was done in a short time, involving the transfer of equipment from one plant to another and the reorganization of storage and distribution facilities so as to handle a daily quantity of oil three times as great as that for which these facilities were originally designed.

The paper gives an extremely interesting account of the original functions of the Heysham plant, a detailed description of its functions after re-design, and also main difficulties encountered and how they were surmounted.

Mr Pracy, the manager of Heysham Refinery, in proposing a vote of thanks to Mr Kirby expressed the hope that this first branch meeting in Morecambe would be the first of many and although he appreciated that the very large attendance was no doubt a reflection on the popularity of Mr Kirby, there was no doubt about the growing interest at Heysham in the activities of the Stanlow Branch.

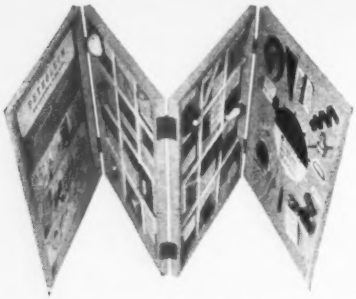
"PETROLEUM HORIZONS"

Under the title of "Petroleum Horizons" the Lummus Company has published its 1950 handbook, an 80 page volume covering refinery and chemical processes.

Thirty-one coloured refining and processing flow charts are included as well as many photographs of the company's installations throughout the world. Main chapter headings of the text are Distillation, cracking, coking and polymerization; Aviation gasoline; Lube oil processing; Light products treating and finishing; and Chemicals from petroleum.

The Lummus Company states that copies of the book will be sent free of charge on request. Applications should be made to the company at 385, Madison Avenue, New York, 17, N.Y.

PETROLEUM IN THE HOME



Another example of the activity of the Petroleum Information Bureau in making known the ever-increasing uses of petroleum products is its cabinet on *Petroleum in the Home*.

This consists of four connected panels, opening out to a size of 5 feet in length by 20 inches high. The panels are 1 inch deep and contain illustrations and models depicting such diverse uses as egg or fruit preservation and boot polish, nail varnish and rubber tyres, plastics and paints, etc.

The cabinets are available on loan to schools and lecturers from the Bureau at 29 New Bond Street, London, W.1.

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CHEMICALS FROM PETROLEUM

The paper by H. E. Charlton on "Some engineering aspects of building a plant for the production of chemicals from petroleum" has been produced in booklet form. Originally read before the Manchester Association of Engineers, the paper describes in detail the building of a plant capable of treating 75,000 tons of naphtha per annum. The booklet is illustrated by a number of photographs and diagrams.

Ideal Type T-16 Consolidated Rig, designed for shallow drilling and workover jobs, with a rating of 160 h.p., is described in a bulletin, copies of which can be had from The National Supply Co., Box 899A, Toledo, Ohio. U.S.A.

MIDDLE EAST PRODUCTION

Crude oil production in the Middle East in the first three months of 1950 was 300,000 tons higher than in the preceding quarter and about 1,700,000 tons greater than in the corresponding period of 1949, reports *Petroleum Press Service:* Details given are:

OIL PRODUCTION IN THE MIDDLE EAST*

	1st quarter 1949	2nd quarter 1949	3rd quarter 1949	4th quarter 1949	1st quarter 1950
	Thousand Metric Tons				
Persia	6,512	6,870	6,773	7,080	7,420†
Saudi Arabia	6,248	6,162	5,246	5,855	5,475
Kuwait	2,920	3,242	2,800	3,405	3,527
Bahrein	375	375	377	381	362
Qatar	–	–	–	–	324‡
Total Persian Gulf	16,055	16,649	15,196	16,721	17,108
Iraq	587	711	1,227	1,318	1,257
Total Middle East	16,642	17,360	16,423	18,039	18,365

* Excluding Egypt.
† Provisional.
‡ Regular production commenced in January, 1950.

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NEW ANTWERP REFINERY

A 30,000 brl/day refinery is now being constructed at Antwerp for the Société Industrielle Belge des Pétroles. Completion of the plant is scheduled for the middle of 1951.

Financed by Belgian interests, the plant will utilize normal refining processes and will have facilities for operation as a completely integrated refinery. Extensive development work is being undertaken by the Port of Antwerp Authority to improve facilities for the ships bringing crude oil to this refinery.

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New Leaflets have been produced by Griffin & Tatlock Ltd., Kemble Street, London, W.C.2, in respect of the following: G & T Universal laboratory stirrer; Microid polishing aluminas; Pyrex brand 5/8 in bore pipe lines; Stanton balances; Microid flask shaker; G & T cylindrical oven.

QATAR ARBITRATION AWARD

The Concession granted by the Shaikh of Qatar to the Anglo-Persian Oil Company on May 17, 1935, and assigned with the agreement of the Shaikh to Petroleum Development (Qatar) Limited in 1946, gave to the company the sole right throughout the Principality to search for, extract and export petroleum and natural gases. The State of Qatar was defined as the whole area over which the Shaikh rules, and which was marked on the north line on a map attached to the Concession.

The Shaikh having on June 8, 1949, proclaimed his sovereignty over the sea-bed and subsoil lying beneath the high seas contiguous to the territorial waters of Qatar, the company claimed that its Concession extended both over the territorial waters of Qatar and over the area covered by the Proclamation. This claim was disputed by the Shaikh who had entered into negotiations with a third party with a view to granting them a Concession over his territorial waters and the sea-bed of the adjacent high seas.

In accordance with the terms of the 1935 Concession, the dispute was submitted to arbitration.

The hearing took place in Qatar in February, 1950, when the following decision was reached.

That the Concession includes islands over which the Shaikh ruled at the date of the Concession, whether or not they are shown on the map attached to the Concession.

That the Concession includes the bed and subsoil of all the inland or national waters, (i) of the mainland of the State of Qatar lying to the north of the line drawn on the map attached to the Concession, and (ii) of the islands mentioned in the preceding paragraph.

That the Concession includes the sea-bed and subsoil beneath the territorial waters, (i) of the mainland of the State of Qatar lying to the north of the line drawn on the map attached to the Concession, and (ii) of the islands already mentioned.

That the Concession does not include the sea-bed or subsoil or any part thereof beneath the high seas of the Persian Gulf contiguous with such territorial waters and more particularly mentioned in the Shaikh's Proclamation of June 8, 1949.

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NEW OIL AGREEMENT

The Ministry of Fuel and Power announced on June 8 that an agreement had been reached by H.M. Government both with the Standard Oil Company of New Jersey and with the Socony Vacuum Oil Company concerning the disposal of their share of the oil produced by the Iraq Petroleum Company in which both companies are partners. In future they will make their sales to the sterling area of this oil through a British subsidiary company. They will also be permitted to pay partly in sterling to the Iraq Petroleum Company for oil sold outside the sterling area. This will enable them to sell some of this oil outside the sterling area for sterling instead of for dollars.

This agreement, like the arrangement with the Standard Vacuum Oil Company by which that company agreed to reduce the dollar content of oil imported into the sterling area from Indonesia which was accordingly freed from substitution, was made in pursuance of H.M. Government's policy of dealing with the difficulties of individual American oil companies in a manner compatible with their general objective of reducing the dollar drain on oil wherever possible.

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WOMA COLORIMETER

It is regretted that on page 159 of the article on "Colour" in the May issue, the WOMA colorimeter was described as having two glass cells. This instrument has only one cell, which is metal.

INTERNATIONAL ROAD CONGRESS

Arrangements are being made for the holding of the next International Road Congress in Portugal and a recommendation has been made that it should take place at the beginning of September 1951.

A series of subjects have been selected for discussion and those likely to be of interest to the petroleum industry are set out below, together with the names of some of those who have been invited to co-operate in the writing of papers.

Question 1. *Progress since* 1938 *in preparation and use on roads and runways of plastic binders.*

Bitumen and asphalt:
A. W. Attwooll (Limmer & Trinidad Lake Asphalt Co.)
T. W. Mathias (Shell-Mex & B.P. Ltd.)

Emulsions:
E. R. Hatt (Dussek Bitumen & Taroleum Ltd.)
W. L. Pearce (Colas Products Ltd.)

Question IV. Economic justification of road works.
C. T. Brunner (Shell-Mex and B.P. Ltd.)

Among the other subjects for discussion will be one concerning soil stabilization for road foundations and surfacings.

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SILVERTOWN LUBRICANTS LTD.

Silvertown Lubricants Ltd., recently celebrated its 21st anniversary as a wholly-owned subsidiary of Gulf Oil Corporation and has announced that the parent company merged all its marketing interests in Great Britain under the title of Gulf Oil (Great Britain) Ltd., as from March 31.

To mark the occasion, an interesting book entitled "Gulf Oil" as been circulated. This shows in pictures the story of Gulf and illustrates operations in all phases of the industry.

AIRBORNE MAGNETOMETER SURVEY

The first large-scale airborne magnetometer survey of the Peace River area, in northwest Alberta, was recently began by Canadian Aero Service Ltd. on behalf of four oil companies—Socony Vacuum Exploration Co., Stanolind Oil and Gas Co., Imperial Oil Ltd. and Canadian Gulf Oil Co. Because of the high cost of aerial surveys, the idea of undertaking them on a co-operative basis, first tried out in a five-company oil search in the Bahamas, has been followed in several regions.

In Alberta, where the area is heavily forested and ground exploration is slow and costly, the aerial survey method is considered to have many advantages.

Twin-engine Anson planes, whose equipment includes an aerial mapping camera, a Sonne continuous strip camera which records the path of the plane during the survey and the new high sensitivity Gulf airborne magnetometer.

The survey will be flown at an altitude of 1000 ft in a series of parallel lines spaced at 1½ mile intervals. Over 16,000,000 acres will be mapped.

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CONDOR INCREASE CAPITAL

The capital of Condor S.p.A. per l'Industria Petrolifera e Chimica has been increased to three thousand million lire. The new capital will finance the construction work now in progress, which comprises a seaport installation at Genoa, a pipeline, with a capacity of 12 million brl (1.5 million tons) per annum to transport crude oil from Genoa to Rho, near Milan, and a refinery at Rho with a capacity of more than 1 million tons p.a.

Horton Floating Roofs. Three types of floating roof are described in a booklet available from the Chicago Bridge & Iron Co., 332 South Michigan Avenue, Chicago.

SPEEDING UP PUBLICATION

In the April 1, 1950 issue of *Nature* there appears an editorial partly concerned with the time which must elapse between the receipt of a communication and its publication. It is pointed out that it is not everywhere realized by correspondents that they can assist in achieving "prompt publication in various ways. An important one is by making sure that their manuscripts represent their final words on what they desire to publish... Author's corrections on proofs are, of course, inevitable; but by reducing them to the essential minimum, much valuable time and effort can be saved... It does not seem to be realized that even trivial corrections generally involve skilled handiwork... Much editorial work would also be spared if authors would take care in their manuscripts to follow the printed style for the quotation of references, and in other minor matters used in the journal to which they propose to submit their communications."

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OIL BURNER MANUFACTURERS A.G.M.

The Annual General Meeting of the British Oil Burner Manufacturers Association held on May 3 in London, was preceded by a luncheon at which the principal guests were C. M. Merrick, M.Inst.Pet., a director of Shell-Mex and B.P. Ltd., and L. Sinclair, M.Inst.Pet., a director of Anglo-American Oil Co.

At the A.G.M., R. H. G. Sutton, M.Inst.Pet., of Urquhart's (1926) Ltd. was re-elected President of the Association.

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PERSIAN CRUDE PRODUCTION

Production of crude oil in Persia for the month of April 1950 amounted to 2,688,000 tons. For the period January 1 to April 30, 1950, total production was 10,282,000 tons.

APPOINTMENTS VACANT

AN INTERNATIONAL OIL COMPANY with Head Office London requires **Sales Executive** for Karachi branch office. Age 25/30, single. Applicants should have engineering and preferably some sales experience. Initial training given in England. Excellent prospects, good salary, attractive leave arrangements, free passage out and home, and free medical attention. Write, giving fullest details to Box 1050, c/o Institute of Petroleum.

PETROLEUM ENGINEERS required for permanent employment in the London office of well-known Refinery Contractors. Men with technical qualifications coupled with practical refining experience should apply in writing to Box 1052, c/o Institute of Petroleum.

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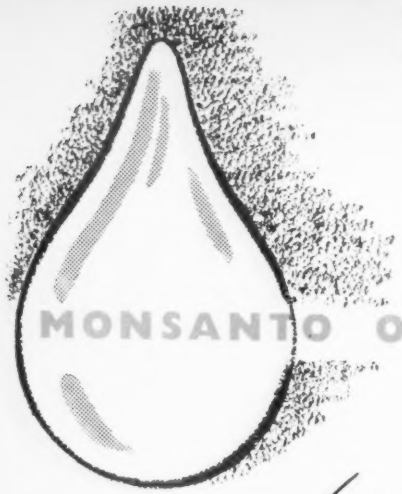

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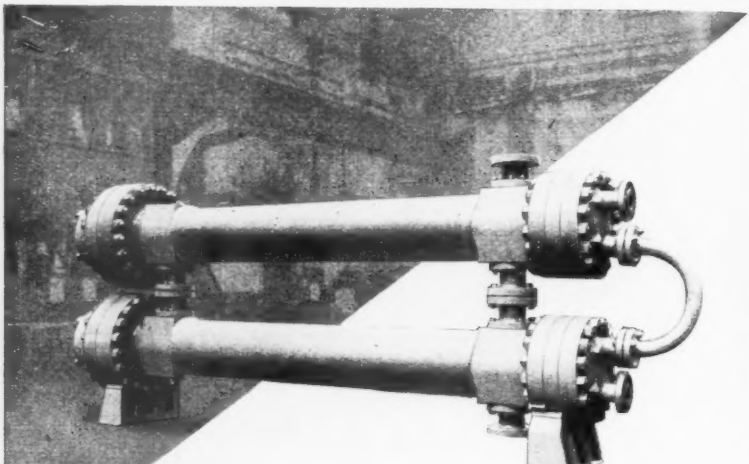

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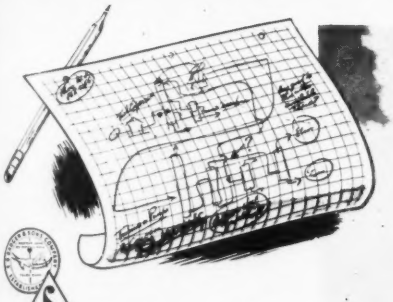

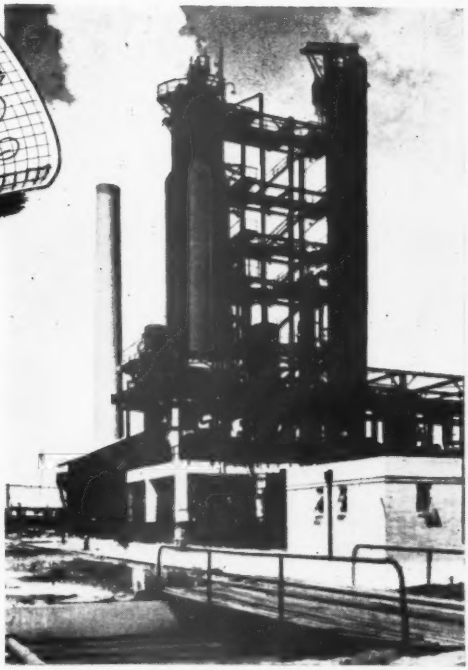

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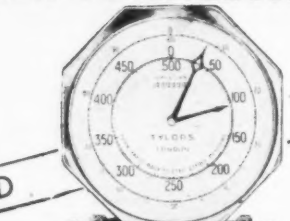

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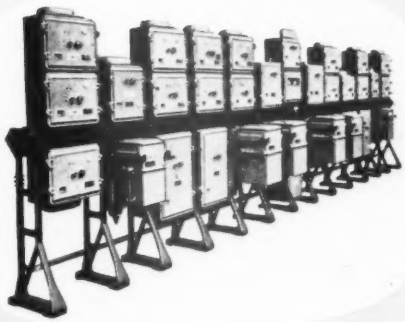

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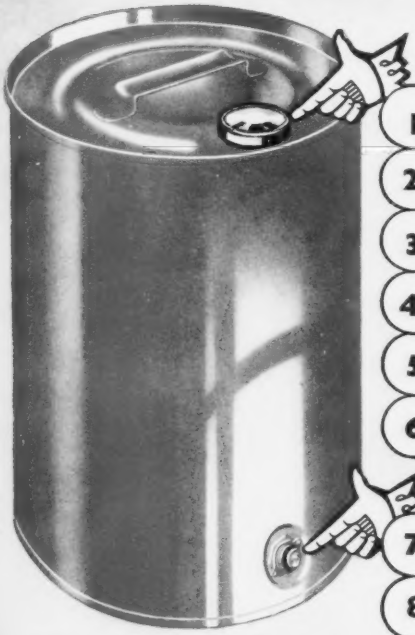

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